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Summary of Some Selected Underground Coal Mine Face Machinery Fatalities–1973

UNITED STATES DEPARTMENT OF THE INTERIOR
Mining Enforcement and Safety Administration
Washington, D. C. 20240

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Summary of Some Selected Underground Coal Mine Face Machinery Fatalities–1973

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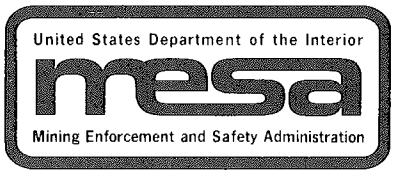

UNITED STATES DEPARTMENT OF THE INTERIOR

Mining Enforcement and Safety Administration

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ILLUSTRATIONS

SUMMARY OF SOME SELECTED UNDERGROUND COAL MINE FACE MACHINERY FATALITIES–1973

by

G. A. Wancheck[1]

ABSTRACT

This descriptive summary is based on Federal coal mine inspectors' reports of face machinery fatalities for the year 1973. The purpose is to determine the cause of each fatality with respect to the equipment involved in each. The report is primarily designed for use in the safety education and training of mining personnel, directly or indirectly involved in the production of coal in underground coal mines. It also should be of value for evaluating and proposing safety criteria for reducing fatalities.

INTRODUCTION

This Mining Enforcement and Safety Administration report gives a brief description of face machinery accidents that occurred during 1973. Accidents are grouped into 10 major categories as follows: (1) Pushing or pulling mine equipment with other equipment; (2) performing tasks under unblocked elevated equipment; (3) operator of self-propelled equipment not facing direction of travel; (4) tramming self-propelled face equipment through check curtains; (5) overhanging brows or rib rolls; (6) electrical shock; (7) work activity in proximity to blasting operations; (8) unattended equipment; (9) changing bits on energized equipment; and (10) unsafe position near moving equipment.

These accident categories were selected in preference to the usual accident classifications of unsafe act, unsafe condition, or unsafe equipment in order to identify and pinpoint the act or task involved at the time of the accident. By doing this, we are hopeful that the accident causes may be determined and corrective measures implemented more readily.

Many of the accidents are similar in nature and are repetitive. Therefore, by identifying these accidents in specific categories, we hope to be in a much better position to propose and promulgate safety criteria that will be acceptable and practiced throughout the underground coal mining industry.

[1]Mining engineer, Industrial Safety Group.

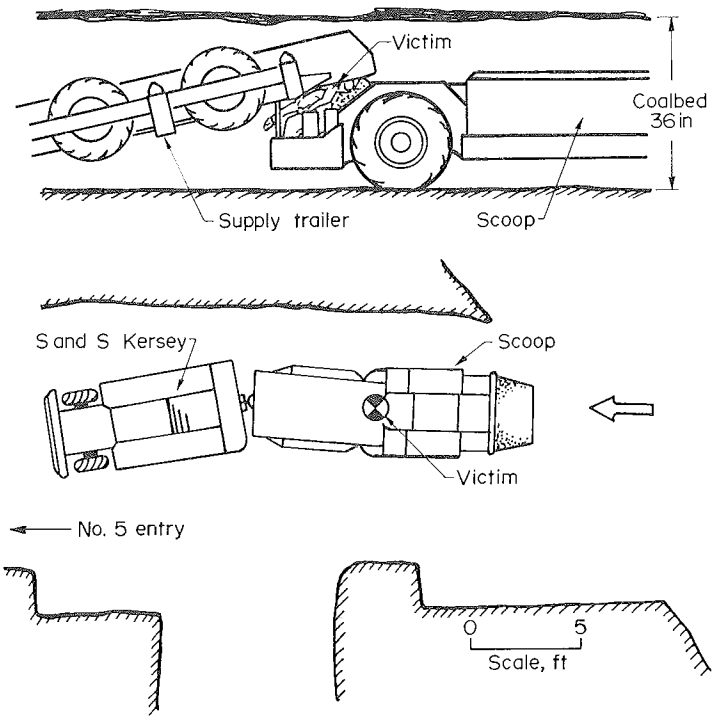
ANALYSIS AND DISCUSSION

The following descriptive sketches were extracted from official mine inspectors' reports. Comments made basically describe the nature of each accident, and corrective measures are offered for consideration. It is suggested that transparencies of each sketch be prepared for overhead projector use in classroom discussions on mine machinery accident prevention.

CATEGORY 1.--PUSHING OR PULLING MINE EQUIPMENT WITH OTHER EQUIPMENT

Figure 1 shows a battery-tractor operator (age 51 with a total of 28 years' mining experience, 8 years in his present job) crushed between a battery-scoop and supply trailer attached to a battery-tractor.

The work activity involved a move-up of the section high-voltage transformer by battery-powered tractor. However, while the tractor operator (victim) was enroute to couple up to the transformer, the tractor malfunctioned electrically and became disabled in the center of the entry. The tractor operator was then instructed by the mine foreman to acquire a battery-powered scoop from the battery-charging station. After arriving with the scoop, the victim with a beltman and shuttle car operator assisting attempted to push the tractor and trailer to one side of the entry for clearance. On the first attempt, they pushed the tractor and trailer about 14 feet before movement became difficult. For the second attempt, the victim backed up his scoop a short distance and rammed into the rear of the trailer which caused the frame of the scoop to go up over the frame of the trailer. A third attempt was made by ramming the scoop into the trailer, causing the end of the trailer to come over the top of the frame of the operator's compartment of the scoop as shown. The accident was witnessed by the shuttle car operator who was steering the disabled tractor and the beltman who was primarily observing.

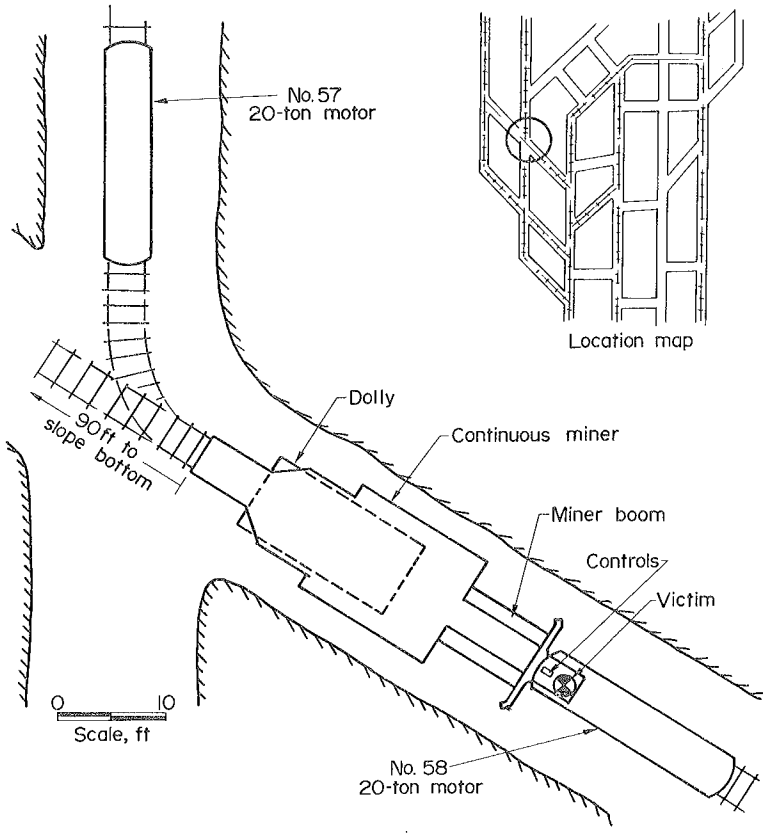


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
7/21/73	Battery-tractor operator, Age 51	28 years	8 years	Battery-tractor and supply trailer scoop

TYPE OF ACCIDENT: Crushed between scoop and supply trailer attached to tractor.

CAUSE OF ACCIDENT: Pushing disabled tractor-trailer with scoop.

FIGURE 1. - Pushing or pulling equipment with other equipment.



DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
6/3/73	Set-up man, Age 30	1 3/4 years	6 months	Continuous miner / 20-ton motor

TYPE OF ACCIDENT: Caught between the deck of a 20-ton motor and the discharge conveyor of continuous miner.

CAUSE OF ACCIDENT: Pushing continuous miner with 20-ton motor without a mine car or another motor between the two units.

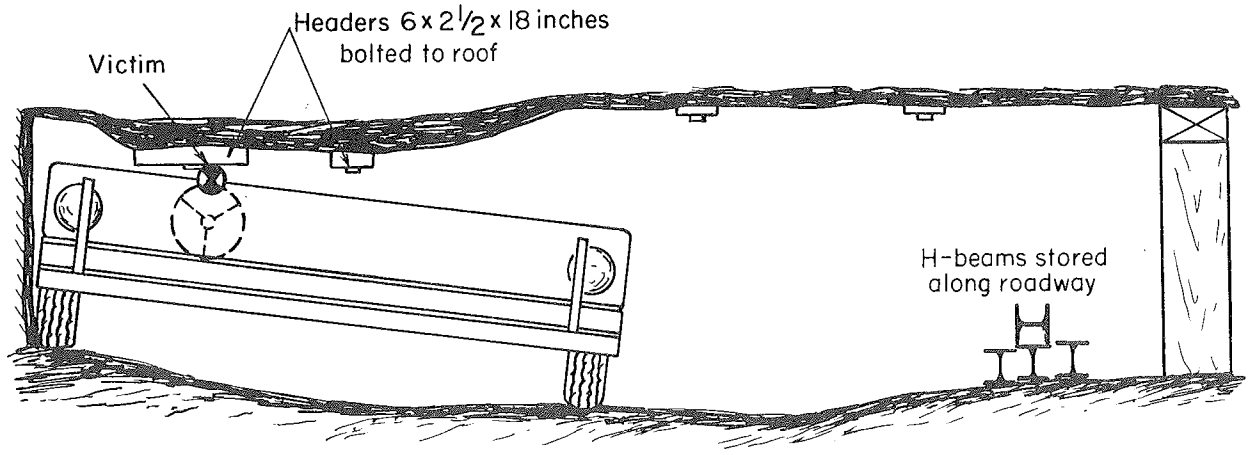
FIGURE 2. - Pushing or pulling equipment with other equipment.

Figure 2 shows a setup man (age 30) caught between the deck of a 20-ton motor and the discharge conveyor of a continuous miner. He had 21 months' mining experience, 6 months of which were in his present job.

The victim was performing the job of a locomotive operator for which he was considered qualified.

The work assignment involved hauling a continuous miner on a dolly from a working section to a slope bottom. Three locomotives were used. One was a 27-ton with a coupled water car. The other two were 20-ton models. In leaving the section, the two 20-tons were coupled together ahead of the continuous miner, and the 27-ton was in front of and on the intake air side of the two 20-tons. On arriving at the slope switch-out station, the 27-ton motor switched-out in a sidetrack, one 20-ton locomotive was uncoupled and switched into a sidetrack, the remaining 20-ton motor pulled the continuous miner to the last switch-out track and uncoupled. The first 20-ton motor that switched out was positioned at the boom end of the continuous miner with the operator's deck adjacent to the boom. In this manner, the motorman (victim) attempted to push the continuous miner to the slope bottom. The result is shown in the sketch.

Figure 3 shows a continuous miner operator (age 40), who also was an incidental battery-tractor operator, crushed between a roof header block and steering wheel of a battery tractor. The victim had a total of 28 years' mining experience, 8 years on his present job. This accident occurred near the end of the shift in a low clearance area while a mantrip skid was being repositioned. The section crew was getting ready to return to the surface. The victim was pushing the chain-coupled skid from the operator's end of the tractor when the accident occurred. There were no witnesses to this accident.



DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
9/15/73	Continuous miner operator, Age 49	28 years	8 years	Battery tractor/Header block Inadequated clearance

TYPE OF ACCIDENT: Caught between header block and tractor steering wheel.
CAUSE OF ACCIDENT: Reversing tractor with coupled mantrip skid in low clearance area. Victim was an incidental tractor operator.

FIGURE 3. - Pushing or pulling equipment with other equipment.

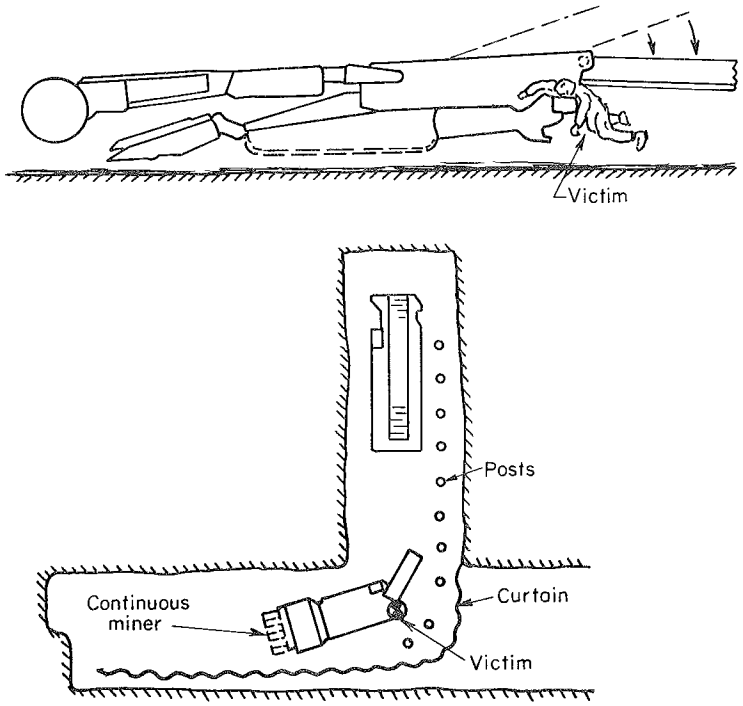
Suggested corrective measures to prevent such "pushing equipment" type accidents include:

1. Disabled or stuck self-propelled equipment, skids, trailers, etc., should not be pushed. Provisions should be made to have disabled or stuck equipment pulled with a drawbar, chain, clevis, or wire-rope coupling. In special instances equipment may be pushed, providing the deck of the operative equipment is positioned at the very end of the train of equipment being pushed and the two pieces of equipment are coupled together.

2. Track-mounted equipment with extended booms or conveyors (loading machines, continuous miners, coal and roof drills, and cutting machines), when being pushed or pulled by a locomotive, should have an independent unit of equipment such as an empty mine car or flatbed placed between the two pieces of equipment. This mine car or flatbed will take up the distance extended by the boom or conveyor and serve as a protective buffer. The operator must be in the deck of the operative equipment positioned at the very end of the train of equipment being pushed or pulled.

CATEGORY 2.--PERFORMING TASKS UNDER UNBLOCKED ELEVATED EQUIPMENT

Figure 4 shows a mechanic crushed between the discharge conveyor and bumper of a continuous miner. He had a total of 20 years' mining experience, 1-1/2 months in his present job. While performing a routine task, the victim had



DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
1/29/73	Mechanic, Age 43	20 years	1½ months	Continuous miner / Discharge conveyor

TYPE OF ACCIDENT: Crushed between discharge conveyor and bumper of continuous miner.

CAUSE OF ACCIDENT: Hydraulic pressure to elevating jack or discharge conveyor was lost while victim was making repairs under unblocked discharge conveyor.

FIGURE 4. - Performing tasks under unblocked elevated equipment.

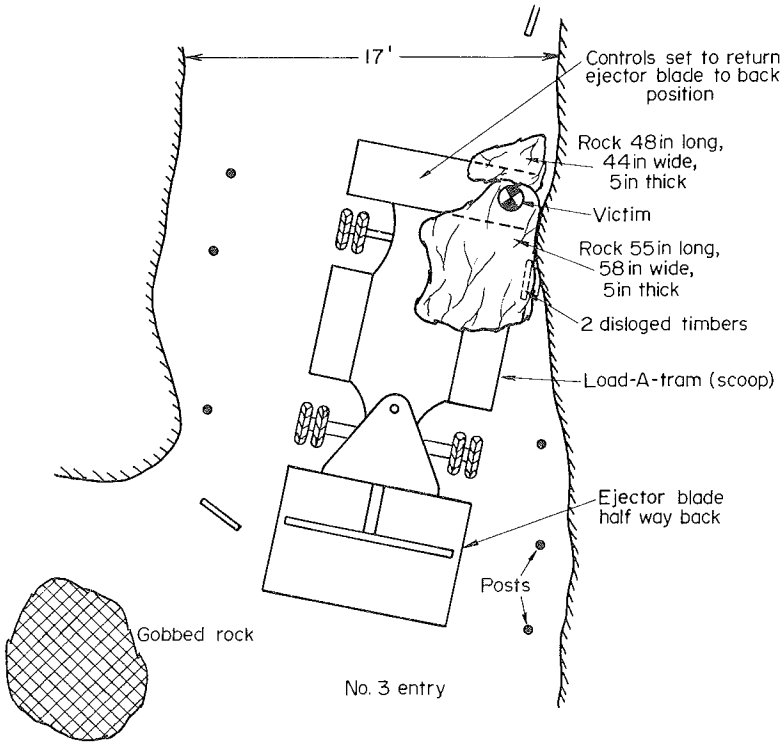
positioned himself in an unsafe position by attempting to repair a hydraulic hose fitting under the unblocked elevated discharge conveyor. Hydraulic pressure to the elevating jack of the discharge conveyor was lost while the victim was making these repairs. It was conjectured by the investigating committee that the victim, while attempting to tighten the hydraulic hose fitting, inadvertently disconnected the hose fitting which relieved the pressure from the hydraulic system and permitted the boom to fall.

Another similar-type accident occurred involving a 32-year-old greaser who had a total of 8 months' mining experience. The victim was in the process of removing the flushing plug from the bottom of the gathering head gear case (pot) at the time of the accident. The gathering head which was in the elevated position for the job was lowered when another mechanic inadvertently activated the head control lever while removing a cover of the master switch compartment.

Corrective measures:

1. As specified in Section 75.1726(b), no work shall be performed under machinery or equipment that has been raised until such machinery or equipment has been securely blocked in position.

2. As specified in Section 75.1725(c), repairs or maintenance shall not be performed on machinery until the power is off and the machinery is blocked against motion, except where machinery motion is necessary to make adjustments.



DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
1/25/73	Scoop operator, Age 52	33 years	2 1/2 years	Scoop/roof fall

TYPE OF ACCIDENT: Crushed between scoop and fall of roof.

CAUSE OF ACCIDENT: Tramming scoop in reverse-disloging props which caused roof rock to fall onto victim.

FIGURE 5. - Operator not facing direction of travel.

CATEGORY 3.--OPERATOR OF SELF-PROPELLED EQUIPMENT NOT FACING DIRECTION OF TRAVEL

Figure 5 shows the accident scene involving a scoop operator who was crushed between the scoop and a fall of roof. He had had a total of 33 years' mining experience of which 2-1/2 years were in his present job. He was assigned the tasks of loading, hauling, and dumping in a cleanup operation of an old entry. After unloading the bucket of material near the mouth of the crosscut, the victim placed the control lever for the ejector blade in the retracting position, and was apparently facing the bucket end of the scoop as he backed into and dislodged three props along the right rib of No. 3 entry. In doing so, the rock fell onto the victim.

Corrective measures:

1. As specified in Section 75.1403-10(j), Subpart O, Title 30, Code of Federal Regulations, operators of self-propelled equipment should face in the direction of travel.

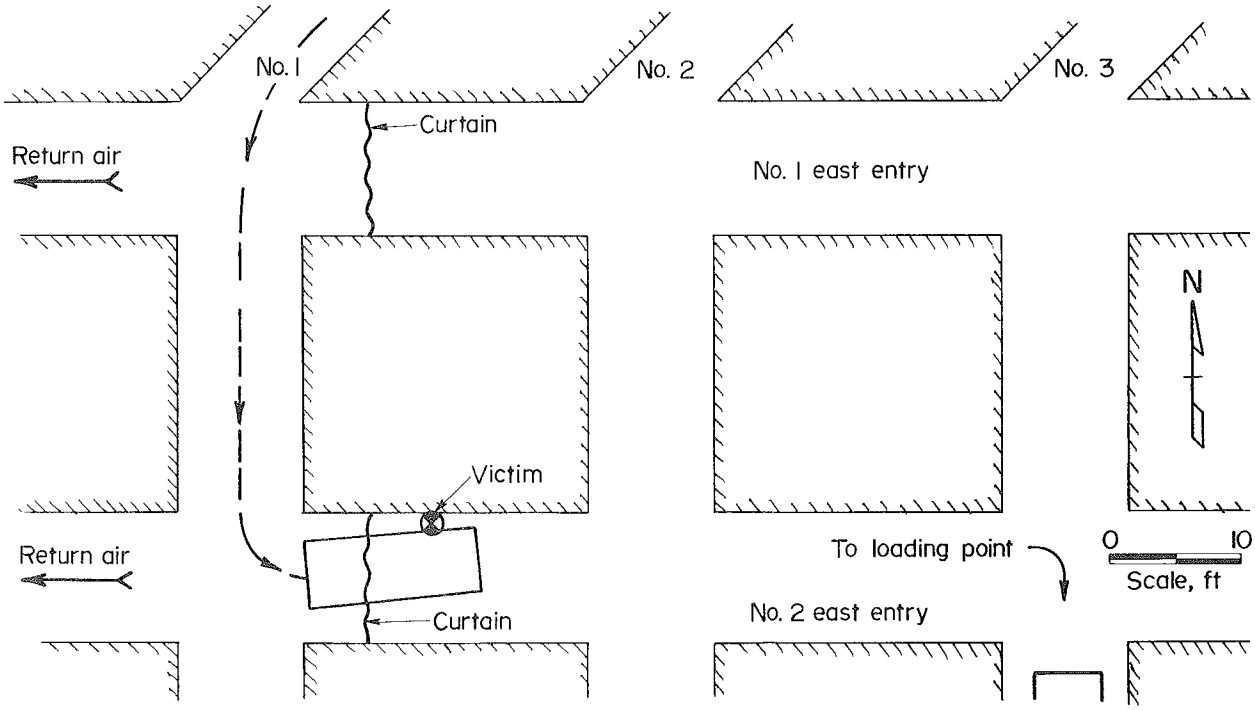
2. As specified in Section 75.1403-10(h), a total of at least 36 inches of unobstructed side clearance (both sides combined) should be provided for all rubber-tired haulage equipment where such equipment is used.

CATEGORY 4.--TRAMMING SELF-PROPELLED FACE EQUIPMENT THROUGH CHECK CURTAINS

Figures 6, 7, and 8 show typical check-curtain accidents involving self-propelled electrical equipment such as shuttle cars, personnel carriers, tractors, scoops, roof bolting, and cutting machines. Figures 9 through 17 show identical check-curtain accidents which occurred in previous years. They are presented here to emphasize the need for regulations on the use of check curtains installed on haulageways. Because of the self-explanatory descriptive details shown in each sketch, we believe it is not necessary to singly elaborate on the events leading up to the occurrence of each accident.

Corrective measures:

The installation of check curtains on haulageways poses a constant hazard to all mining personnel working in such areas. Ideally, ventilating systems should be established to course the intake air to each working face of a section without the need for check curtains on haulageways. Unfortunately,

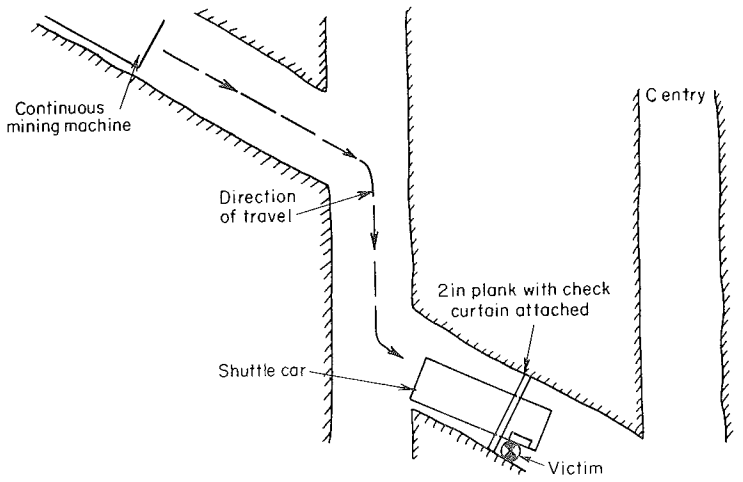


DATE	OCCUPATION	EXPERIENCE		EQUIPMENT
		TOTAL	PRESENT JOB	INVOLVED/AGENCY
1/25/73	Shuttle car operator, Age 46	17 years	15 years	Shuttle car/check curtain

TYPE OF ACCIDENT: Crushed between deck of shuttle car and coal rib.

CAUSE OF ACCIDENT: While tramming through check curtain victim became entangled with the curtain material subsequently losing control of shuttle car.

FIGURE 6. - Tramming self-propelled equipment through check curtains.

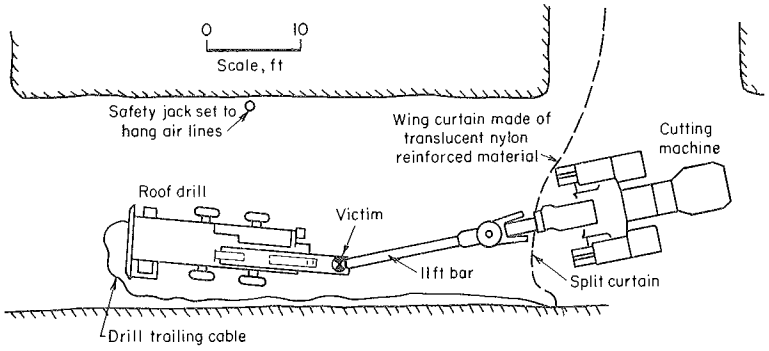


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
2/5/73	Mechanic, Age 41	2½ years	2½ years	Shuttle car / Header plank

TYPE OF ACCIDENT : Struck head against 2 in roofbolting plank while tramming through check curtain.

CAUSE OF ACCIDENT : Tramming through check curtain in a low clearance area. The victim was an incidental shuttle car operator.

FIGURE 7. - Tramming self-propelled equipment through check curtains.



DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
11/9/73	Roof-bolter Age 23	3 years	3 years	Cutting machine / check curtain and roof bolting machine

TYPE OF ACCIDENT : Struck by the bar of a cutting machine white sitting on the drill head of a roof-bolting machine.

CAUSE OF ACCIDENT : Parking in proximity of check curtain. Passing through check curtain with bar leading.

FIGURE 8. - Tramming self-propelled equipment through check curtains.

this is not always possible. Check curtains continue to be used on haulageways, thereby resulting in direct-causal or contributing factors of many accidents. To alleviate or possibly eliminate the check-curtain-type accident, the following is recommended:

1. Check curtains be installed with full consideration to the safe passage of personnel and self-propelled face equipment.

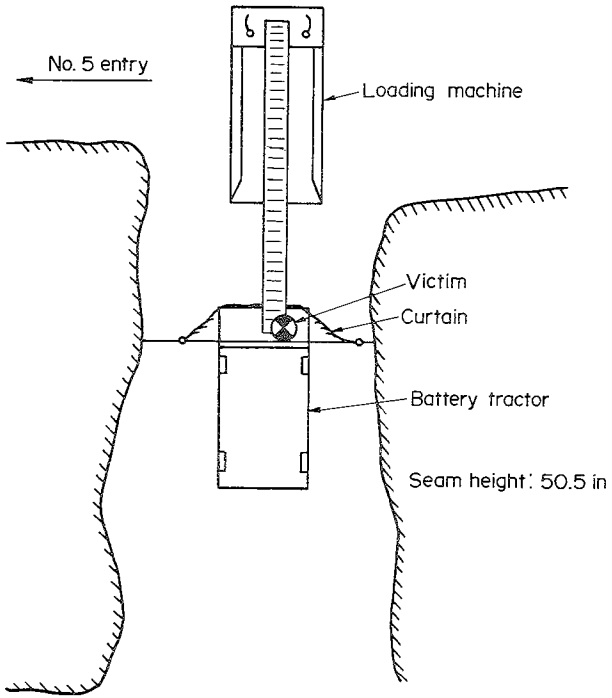
2. All check-curtain framework requiring props, crossbars, or planks, etc., be outlined on each side and top with reflective warning material to indicate the obstructions.

3. A minimum equipment clearance of 36 inches of unobstructed side clearance (both sides combined) be provided at each check curtain.

4. To lessen the possibility of the check curtain snagging control levers and/or loose material on self-propelled face equipment, a minimum of three (3) vertical slits at each crossing point be maintained in each check-curtain installation.

5. An audible warning device be provided and maintained on all self-propelled face equipment and operators of such equipment be required to stop and sound an audible alarm before passing through a check curtain.

6. Self-propelled face equipment not be parked within 20 feet of either side of a check curtain installed in an active haulageway.

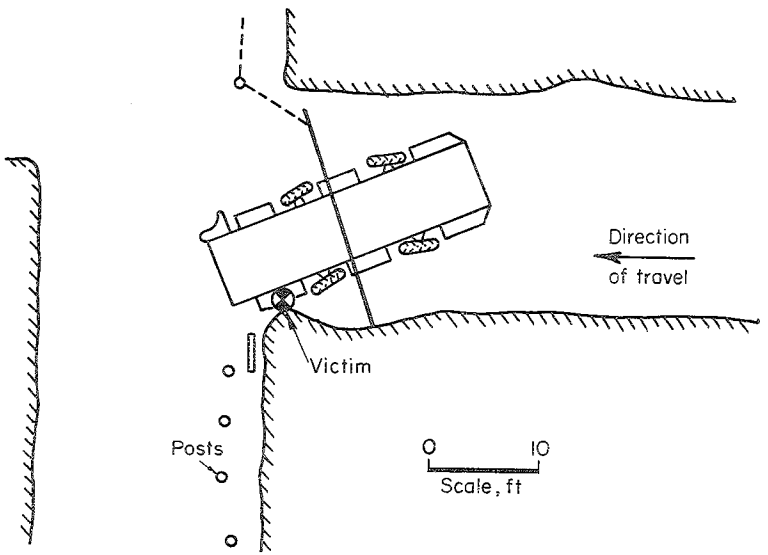


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
3/30/70	Battery-tractor operator, Age 58	30 years		Battery-tractor loading machine/ check curtain

TYPE OF ACCIDENT: Crushed between the discharge conveyor of a parked loading machine and a battery-tractor he was operating.

CAUSE OF ACCIDENT: Parking the loading machine adjacent to a check curtain and passing through same.

FIGURE 9. - Tramming self-propelled equipment through check curtains.

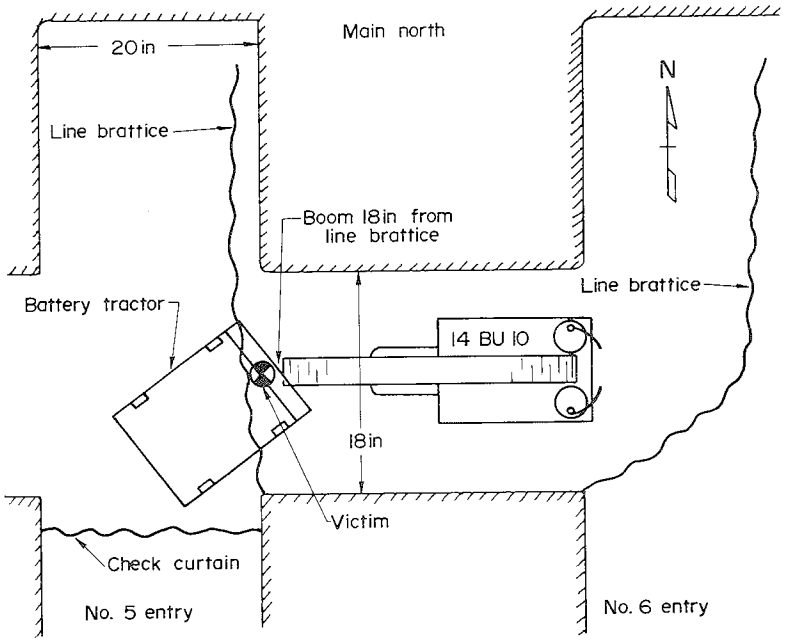


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
8/28/70	Shuttle car operator Age 37	3 1/2 years	1 1/2 years	Shuttle car / Check curtain and rib

TYPE OF ACCIDENT: Crushed between shuttle car and coal rib.

CAUSE OF ACCIDENT: Restriction at entrance to crosscut, improper installation of check curtain.

FIGURE 10. - Tramming self-propelled equipment through check curtains.

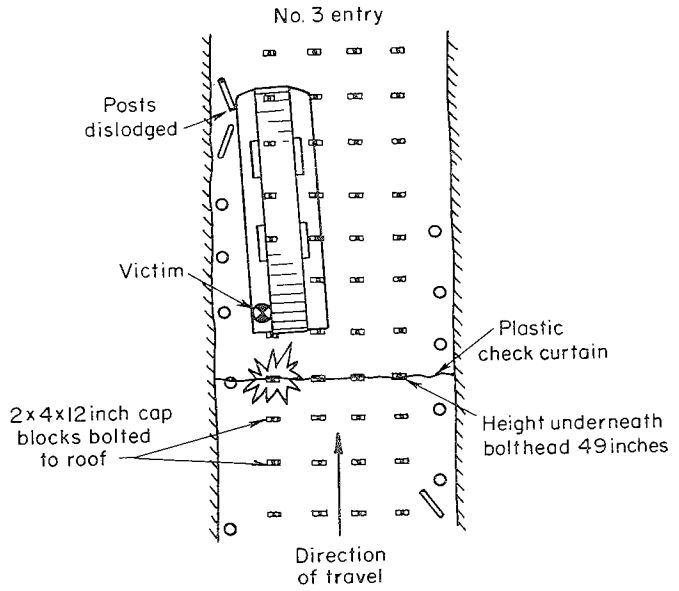


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
8/30/70	Fire boss, Age 52	N/a		Battery-tractor loading machine/ check curtain

TYPE OF ACCIDENT: Crushed between the cab of a battery-tractor he was operating and the boom of a loading machine.

CAUSE OF ACCIDENT: Parking loading machine adjacent to check curtain.

FIGURE 11. - Tramming self-propelled equipment through check curtains.

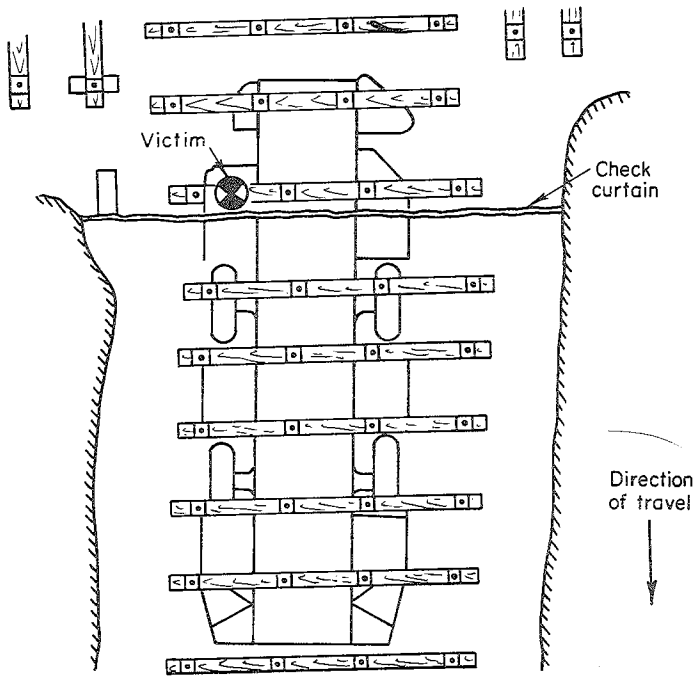


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
8/18/70	Maintenance repairman, Age 26	2½ years	2¼ years	Shuttle car / Check curtain and cap blocks

TYPE OF ACCIDENT: Caught between cap blocks bolted to roof and shuttle car he was operating.

CAUSE OF ACCIDENT: Head clearance decreased by cap blocks obscured by check curtains.

FIGURE 12. - Tramming self-propelled equipment through check curtains.

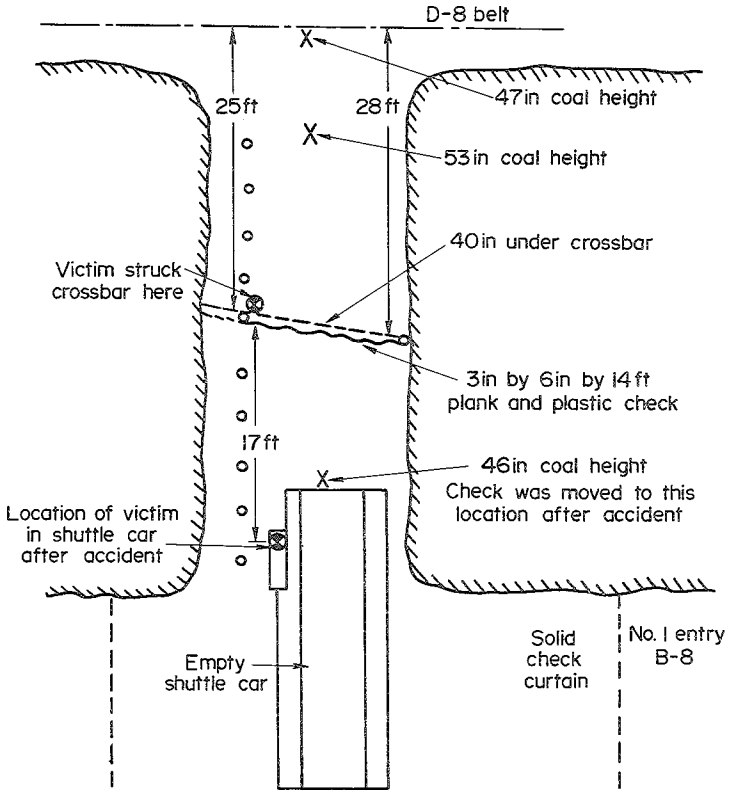


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
12/4/70	Roofbolter, Age 21	1½ years	½ years	Shuttle car / Check curtain and crossbar

TYPE OF ACCIDENT: Caught between crossbar bolted to roof and shuttle car he was operating.

CAUSE OF ACCIDENT: Minimal head clearance at the scene of the accident, 7in between the top of the car and the crossbar.

FIGURE 13. - Tramming self-propelled equipment through check curtains.

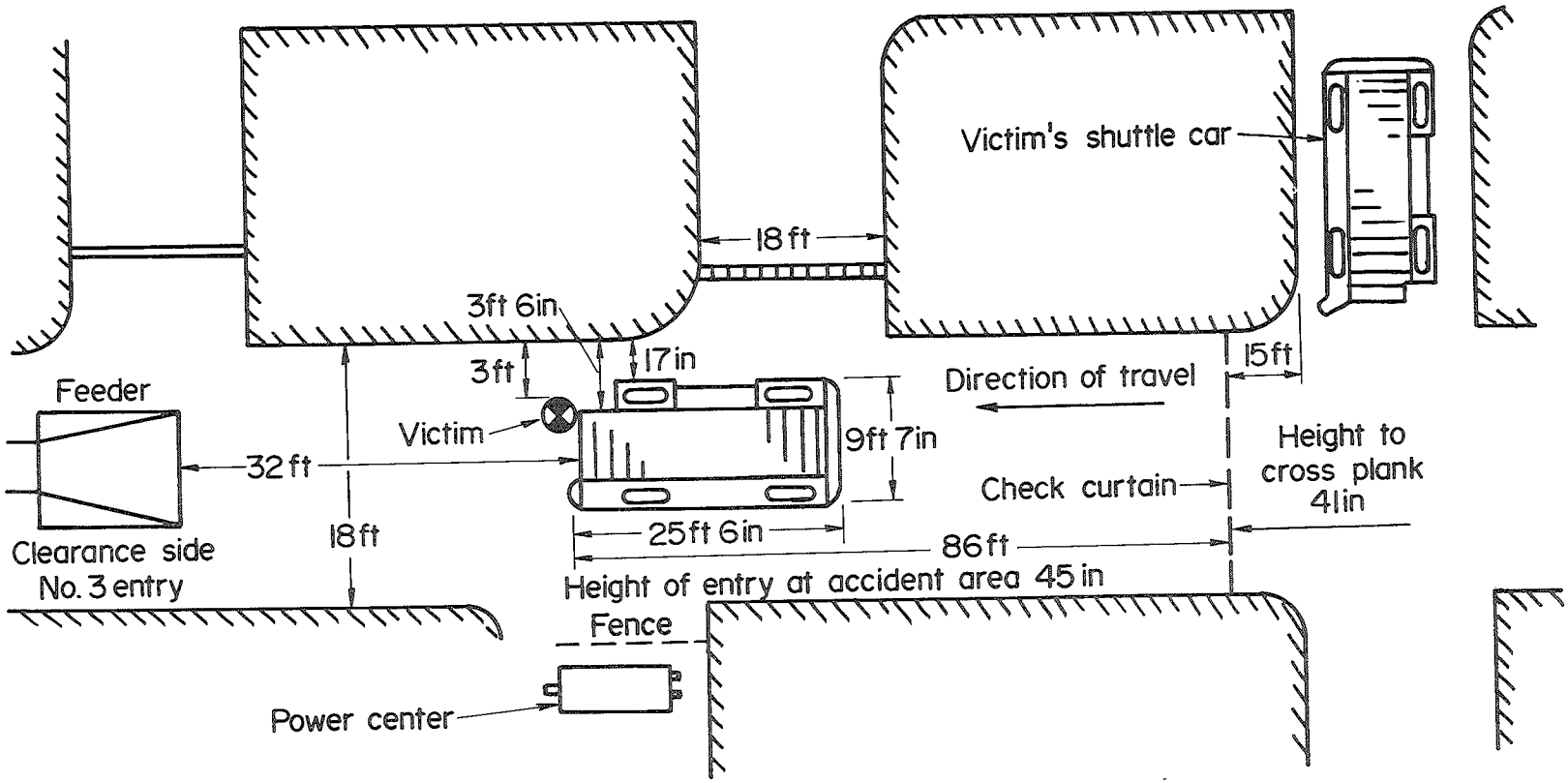


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
1/13/71	Shuttle car operator, Age 54	33 years	3 years	Shuttle car/check curtain and crossbar

TYPE OF ACCIDENT: Caught between crossbar bolted to roof and shuttle car he was operating.

CAUSE OF ACCIDENT: Head clearance decreased by crossbar obscured by check curtain.

FIGURE 14. - Tramming self-propelled equipment through check curtains.

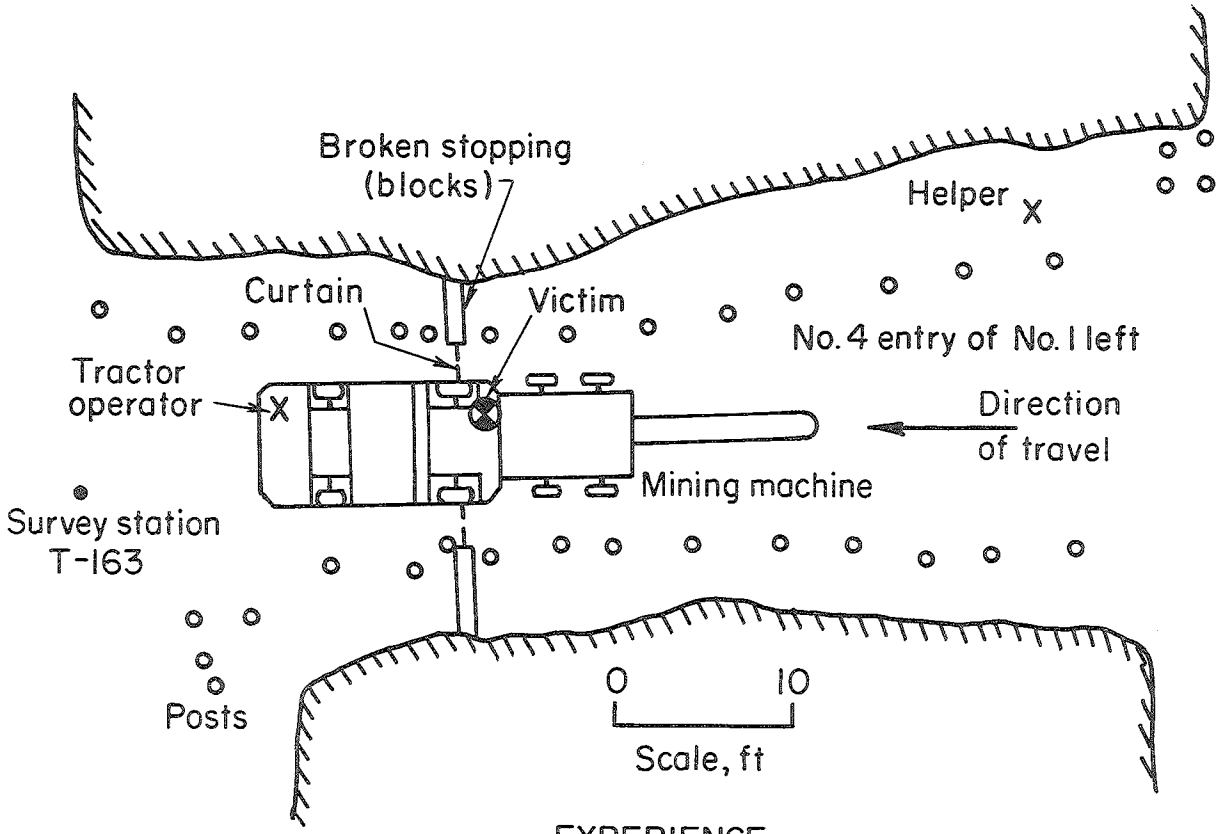


DATE	OCCUPATION	EXPERIENCE		EQUIPMENT INVOLVED/AGENCY
		TOTAL	PRESENT JOB	
3/30/71	Shuttle car operator, Age 62	35 years	20 years	Shuttle car/check curtain and battery tractor

TYPE OF ACCIDENT: Victim was run over by a shuttle car in vicinity of check curtain.

CAUSE OF ACCIDENT: Check curtain obstructing visibility of shuttle car operator–tramming through check curtain–location of victim while walking in entry.

FIGURE 15. - Tramming self-propelled equipment through check curtains.

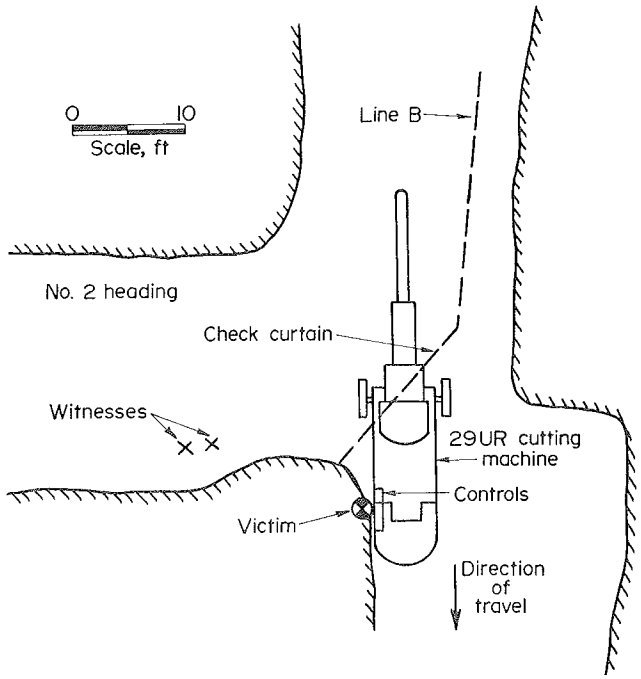


DATE	OCCUPATION	EXPERIENCE		EQUIPMENT INVOLVED / AGENCY
		TOTAL	PRESENT JOB	
4/19/72	Cutting machine operator, Age 57	23 years	13 months	Cutting machine / Check curtain and battery tractor

TYPE OF ACCIDENT: Crushed between tractor and cutting machine he was operating.

CAUSE OF ACCIDENT: Collision between two units of self-propelled equipment passing through check curtain.

FIGURE 16. - Tramming self-propelled equipment through check curtains.



DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
10/19/72	Cutting machine operator, Age 31	3 years	2 years	Cutting machine/ check curtain, rib

TYPE OF ACCIDENT: Caught between coal rib and cutting machine he was operating.

CAUSE OF ACCIDENT: Tramming cutting machine into coal rib through check curtain in "high tram".

FIGURE 17. - Tramming self-propelled equipment through check curtains.

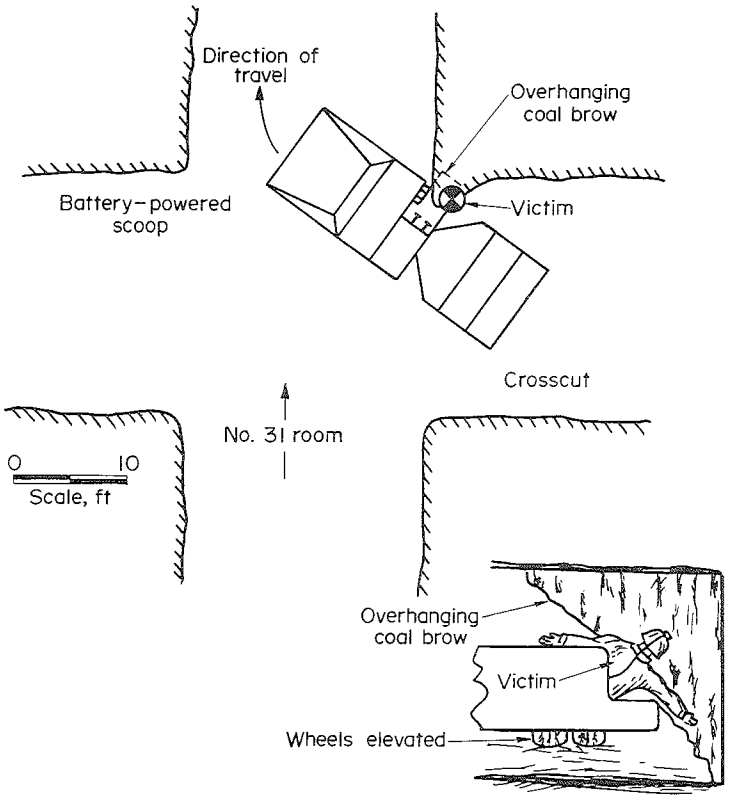
7. Check curtains not be erected in such a manner or location as to conceal irregularities or obstructions in the rib, roof, or roadbed.

CATEGORY 5.--OVERHANGING BROWS AND RIB ROLLS

Figure 18 shows a fatal accident involving a scoop and an overhanging coal brow. The scoop operator (victim) had a total of 6 years' mining experience of which 3 years were in his present job. While in the act of tramming to the face, the victim was crushed between his scoop and the overhanging coal brow. The investigative report revealed substandard conditions existed in the immediate working face area. Specifically, it was noted that poor mining practices prevailed in the face cycle of cutting, drilling, blasting, and loading.

Figure 19 shows a rib coal brow which separated from the rib and rolled onto the loader operator (victim) who was standing beside the loader giving instructions to his shuttle car operator, who was learning to operate the loader. A loader operator instructing his helper is a common practice throughout the mining industry and technically had little or nothing to do with contributing to the cause of this accident. However, figure 19 shows that the selection of the crosscut for giving instructions was somewhat precarious. Other learning-type accidents have resulted in the operator or his helper getting pinned between the loader and rib or crushed between the discharge conveyor and rib.

Again this investigative report revealed substandard practices in the face preparation of coal which contributed to the cause of this accident. The side or width limits of the machine cuts were not compatible with the drill holes for blasting. The machine undercuts ranged from 36 to 66 inches outside the drill holes, a very unacceptable coal-mining practice.

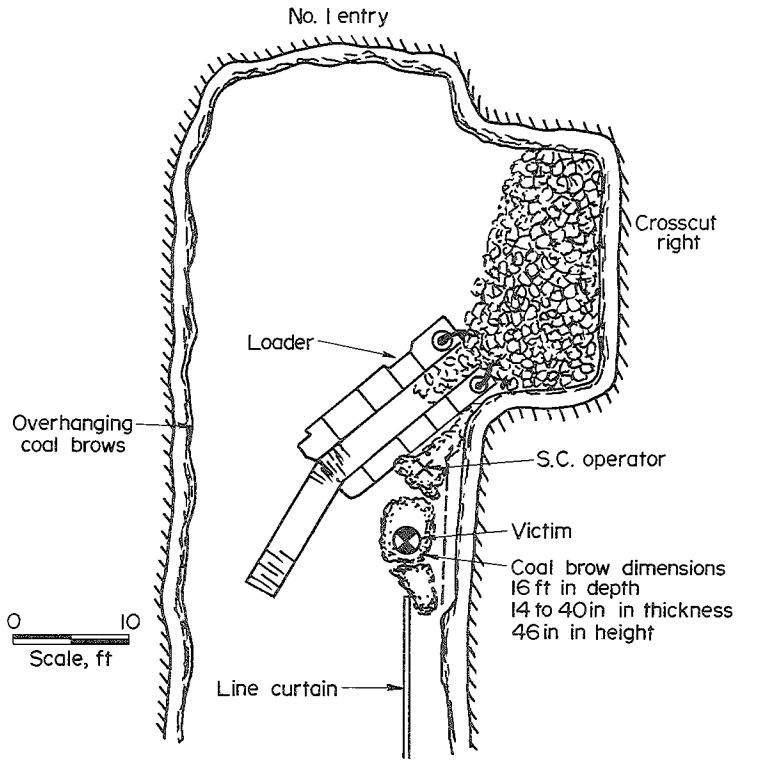


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
2/17/73	Scoop operator, Age 45	6 years	3 years	Scoop/overhanging brow

TYPE OF ACCIDENT: Crushed between the frame of the scoop and overhanging brow.

CAUSE OF ACCIDENT: Tramming into overhanging brow.

FIGURE 18. - Overhanging brows or rib rolls.



DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
3/9/73	Loading operator, Age 27	2 1/2 years	1 year	Loader/coal brow

TYPE OF ACCIDENT: Coal brow rolled onto loader operator instructor.

CAUSE OF ACCIDENT: Coal brow conditions created by unsatisfactory coal preparation techniques. The side limits of the machine cuts were not compatable to the drill hole for blasting. The machine undercuts ranged from 36 to 66 inches outby the blast holes.

FIGURE 19. - Overhanging brows or rib rolls.

Corrective measures:

1. All coal miners must be trained and instructed in the proper methods of testing roof, face, and ribs. Face workers and other employees whose work exposes them to hazards or falls of roof and coal shall thoroughly test the roof, face, and ribs, before starting to work or before starting a machine, and frequently thereafter.

2. Face-preparation techniques in cutting, drilling, and blasting shall be compatible with approved mining practices. Specifically--

a. Drill holes for blasting shall be properly placed with respect to the location, angle, and depth of cut. Drill holes shall not be deeper than the undercutting, centercutting, overcutting, or shearing.

b. Cutting width shall be consistent with the normal entry width. Maintaining continuous markings for the sight line and rib lines is a must in driving development entries.

c. Cutting width of the working face cut shall not exceed 12 inches to either side of the rib drill holes.

3. In the event an overhanging face or rib brow is produced by poor mining practices, the unsafe condition shall be corrected by "squaring up" the face or rib. This may be done by pick scaling, bar wedging, or trimming with the cutter bar.

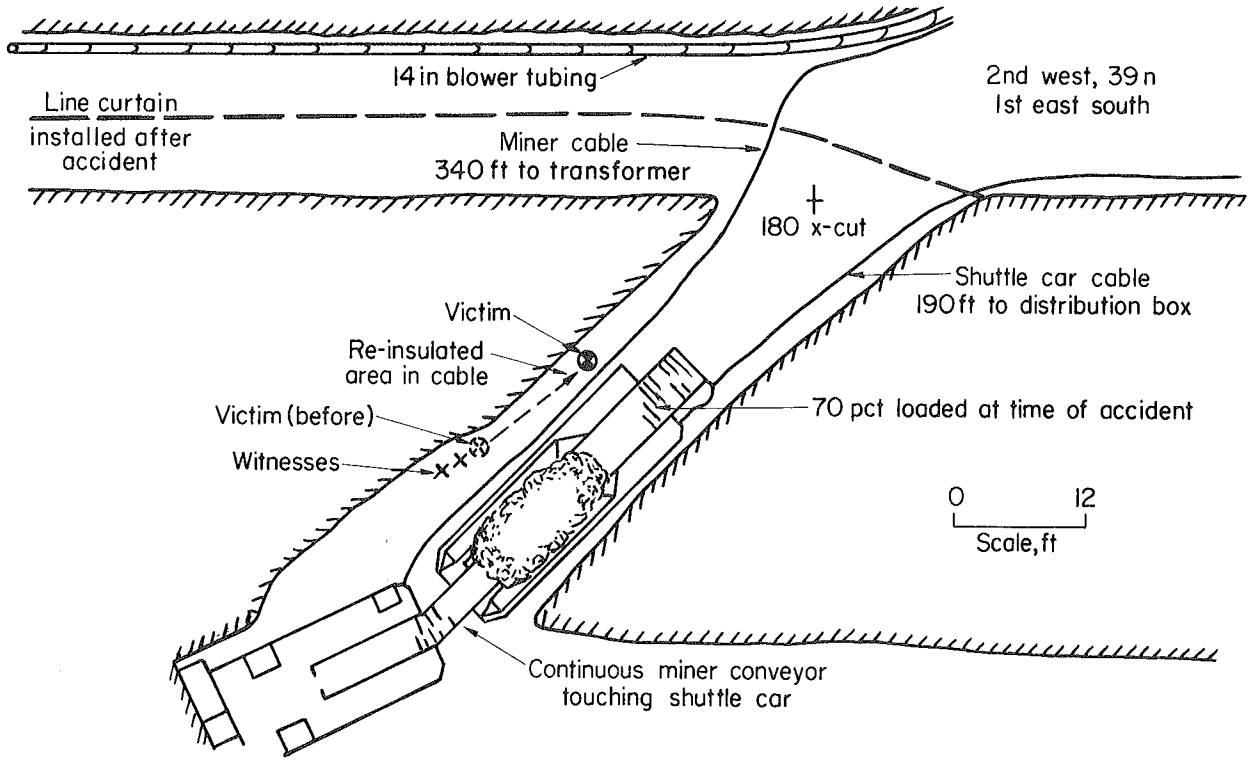
4. Advancement for the next face cut shall not be permitted until the unsafe conditions of overhanging face or rib brows have been corrected.

5. Roof area exposed by the removal of the face or rib overhang shall be supported according to the requirements of each mine-roof support plan.

CATEGORY 6.--ELECTRICAL SHOCK

Figure 20 shows how a continuous miner operator was electrocuted while attempting to shut the conveyor motor off on a shuttle car. The victim had a total of 3 years' mining experience including 9 months in his present job. According to the investigative report a shuttle car in operation for over 2 hours was almost loaded when the circuit breaker opened at the load center after which the shuttle car operator went to reset the breaker. It was evident that he had left the electrical control for the chain conveyor in the "on" position because as soon as the circuit breaker was reset, the chain conveyor started to spill coal onto the bottom. Seeing this, he rushed to shut the chain-conveyor motor off on the shuttle car coming in contact with the energized frame of the shuttle car thereby sustaining the fatal electrical shock.

The investigative report also pointed out that the trailing cable of the shuttle car had strands of phase and ground wires making intermittent contact



DATE	OCCUPATION	EXPERIENCE		EQUIPMENT
		TOTAL	PRESENT JOB	INVOLVED/AGENCY
2/20/73	Continuous miner operator, Age 22	3 years	9 months	Continuous miner/trailing cable and shuttle car

TYPE OF ACCIDENT: Electrical shock.
CAUSE OF ACCIDENT: Victim contacted energized frame of shuttle car. Trailing cable had strands of phase and ground wires making intermittent contact.

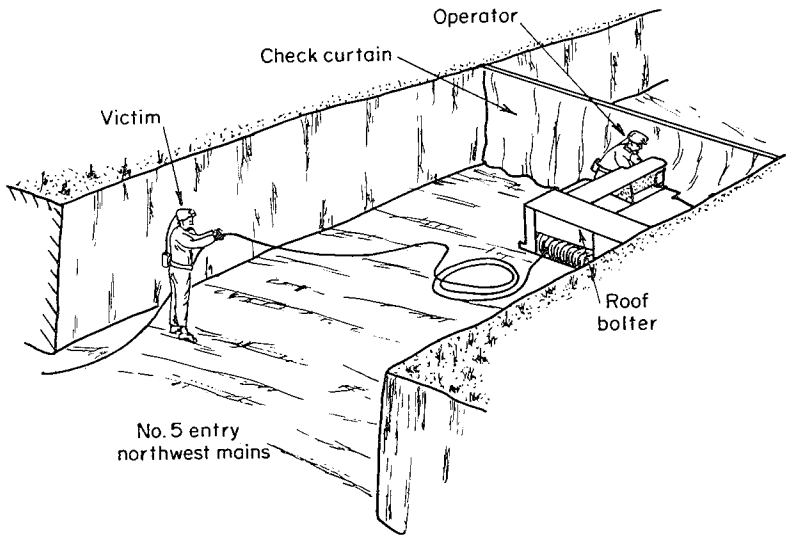
FIGURE 20. - Electrical shock.

at a damaged spot and that the previous shift had similar electrical trouble with the shuttle car.

Figure 21 shows how a section foreman was electrocuted when his unprotected hands came in contact with a bared spot in the trailing cable of a roof-bolting machine. He had a total of 12 years' mining experience.

In brief, the foreman was pulling up cable slack to assist a roof-bolting machine operator in tramming his machine out of a working place. Pulling cable with unprotected hands is a common occurrence and this resulting accident is a typical example of an unsafe act catching up with its performer.

Figure 22 shows how a qualified electrician (age 38, with 11 years' mining experience) was electrocuted when he came in direct contact with energized circuitry on a continuous miner. The continuous miner was down for electrical repairs and the victim was in the process of troubleshooting when the accident occurred. In brief, in the final stage of the troubleshooting, the victim

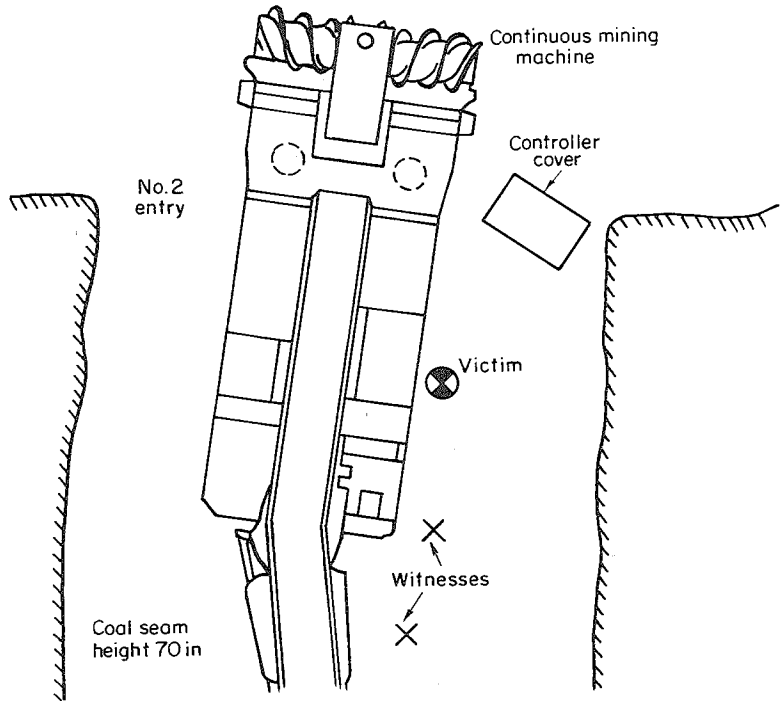


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
5/5/73	Section foreman Age, 32	12 years	—	Roof bolting machine/ Trailing cable

TYPE OF ACCIDENT: Electrical shock

CAUSE OF ACCIDENT: Hands came in contact with a bared spot in the trailing cable. Victim was assisting roof bolter in tramming out of the working face.

FIGURE 21. - Electrical shock.



DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
11/8/73	Electrician	11 years		Continuous miner

TYPE OF ACCIDENT: Electrical shock

CAUSE OF ACCIDENT: Direct contact with energized circuitry on a continuous miner, victim was trouble shooting when the accident occurred.

FIGURE 22. - Electrical shock.

with the main control-panel cover removed was ground-fault checking with a voltohmmeter when he contacted energized wires. The voltohmmeter was found on the continuous-mining machine in the ohms (RX1) position indicating that the victim may have been attempting to localize a ground-fault or a short-circuit with the machine energized. There were three witnesses to the accident, the section forman and two roof bolters.

Corrective measures:

1. All electrical equipment not functioning in a safe manner shall be placed out of service until corrected according to Section 75.512.

2. All equipment operators prior to leaving the operator's position shall deenergize the equipment and make certain that the brakes are set and all control levers are in the neutral or off position.

3. Trailing cables shall be inspected prior to each production shift for bare conductors, cuts, abrasions, defective splices and more than one temporary splice.

4. Protective gloves shall be worn when handling trailing cables.

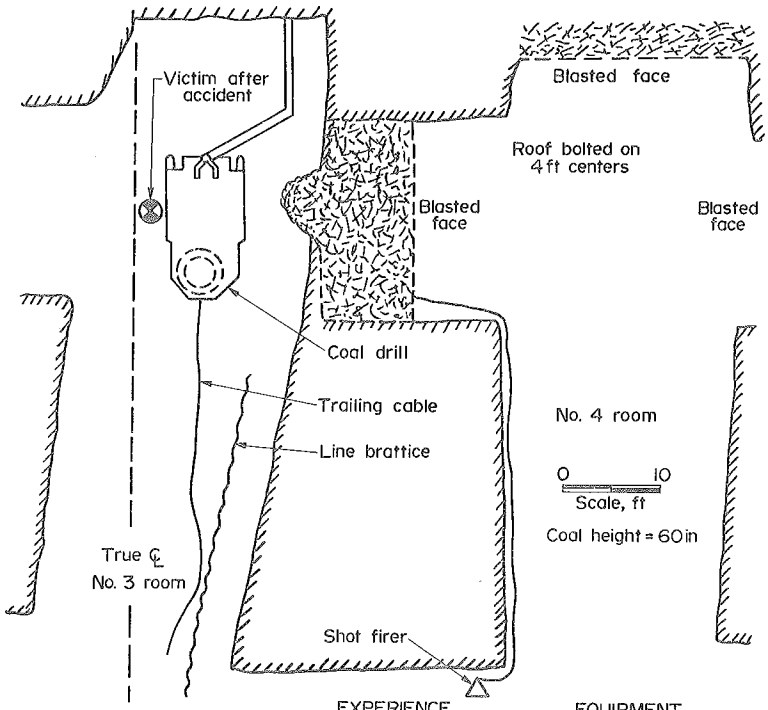


FIGURE 23. - Work activity in proximity to blasting operations.

5. All electrical-powered equipment shall be deenergized and locked out when making electrical repairs to the machine, except when testing or troubleshooting procedures require that the equipment be energized.

CATEGORY 7.--WORK ACTIVITY IN PROXIMITY TO BLASTING OPERATIONS

Figure 23 shows how a coal drill operator (victim) received a fatal blast of coal rib while drilling in an entry adjacent to a blasting operation in a crosscut. The victim, age 48, had 26 years' mining experience, the last 2 years as a coal drill operator. The working section was mined with conventional coal-mining equipment. To be properly mined the coal required undercutting, drilling, and blasting

prior to being loaded mechanically. As shown in the sketch, several unsafe conditions and/or unsafe mining practices were in evidence which contributed to the cause of this accident. Specifically--

1. No. 3 Room advancing off the center line.

2. Work activity in area adjacent to the blasting operation.

3. Simulataneous work activity at a four-way intersection.

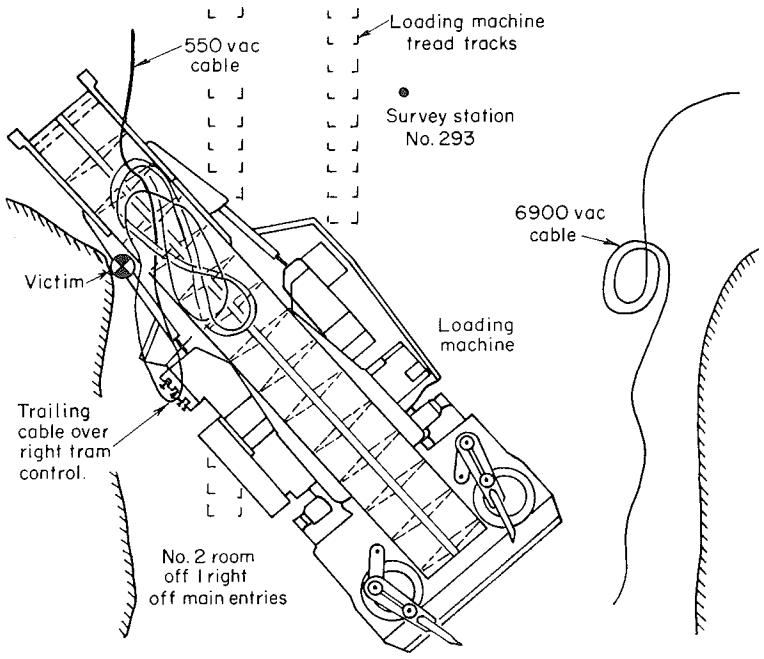
4. No danger board placed at entrance to No. 3 Room.

Corrective measures:

1. A danger board shall be placed across the entries of all accessible areas adjacent to blasting operations. All personnel shall be withdrawn from these same areas.

CATEGORY 8.--UNATTENDED EQUIPMENT

Figure 24 shows how a roof bolter (age 34, with 7-1/2 years' mining experience) was struck by and caught between a loader-discharge conveyor and rib. The victim was an extra loading machine operator who was in the process of tramming when he was cautioned to stop for lack of cable slack. Heeding the warning, the operator stopped tramming and with the loading machine energized proceeded to remove extra cable from the discharge conveyor. In doing this, the trailing cable snagged a tram lever causing the machine to move toward the rib.



DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
3/22/73	Roof bolter Age 34	7½ years	2 years	Loader/Trailing cable, rib

TYPE OF ACCIDENT: Caught between discharge conveyor and rib.
CAUSE OF ACCIDENT: Victim, an extra operator, while pulling stacked trailing cable off energized loading machine activated the tram lever with the snagged trailing cable causing the machine to move toward the rib.

FIGURE 24. - Unattended equipment.

Corrective measures:

1. All equipment operators prior to leaving the operator's position shall deenergize the equipment and make certain that the brakes are set and all control levers are in the neutral or off position.

2. Operating controls shall be provided with protective covers and locking devices to prevent accidental activation.

CATEGORY 9.--CHANGING BITS ON ENERGIZED EQUIPMENT

The accidents which occur while changing bits on energized equipment have been on the increase and have reached the point where regulations had to be mandated. Section 75.1725(c) states that repairs or maintenance shall not be performed on machinery until the power is off and the machinery is blocked against motion, except where machinery motion is necessary to make adjustments. This regulation is applicable to the necessary task of frequent bit changes.

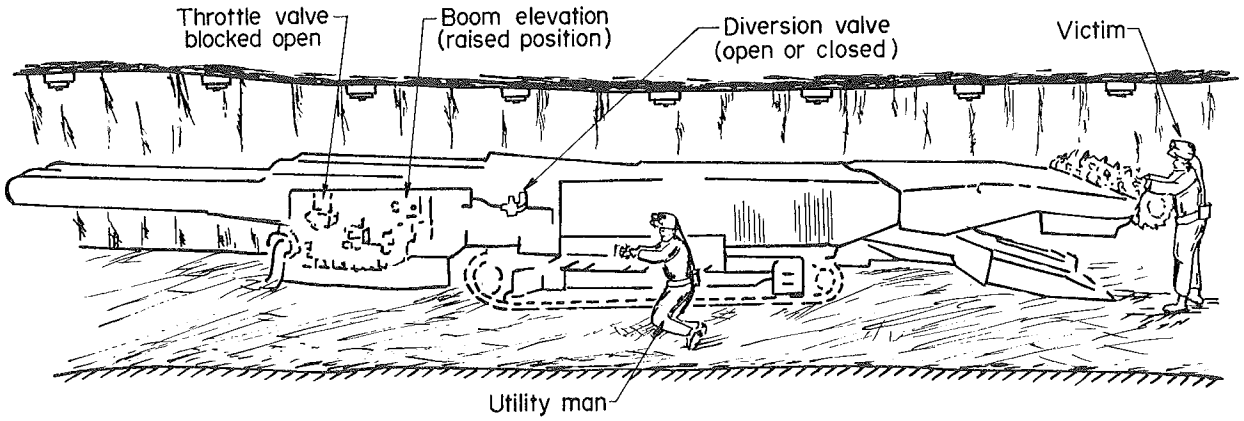
Figure 25 shows how a section foreman (age 43, with 11-1/2 years' mining experience) was crushed between the ripper head of the continuous miner and the mine roof. Servicing of the continuous miner was in progress when the accident occurred, according to the investigation report. The victim was assisting the mechanic in changing bits and a utility man was adding hydraulic fluid to the machine utilizing an integral hydraulic pumping system when the hydraulic pressure to the elevating jacks of the ripper head became activated thereby pinning the victim between the mine roof and the ripper head. The investigation further stated that a company-devised system of pumping hydraulic fluid into the continuous mining machine was in use at the time of the accident. The actual cause of this accident was the position of the diversion valve which had to be closed to pressurize the boom of the continuous miner. One of two conditions existed: either the diversion valve was closed initially, or it became closed during the transfer of oil from the drum to the continuous miner. A contributing factor in the severity of this accident was the victim's "leaning-over position" on the ripper head while changing bits on the energized continuous miner.

In figure 26 we see how a shearing machine operator (age 29, with 3 years' mining experience) was crushed by a shearer wheel. The victim, assisted by the section foreman, was in the process of changing bits on the shear wheel when the accident occurred. According to the investigative report, the power to the shearing machine was not deenergized during the downtime for bit-changing and roof support in a fault area along a longwall face. Witnesses agreed that it was customary to have the shear wheel energized during bit changes with precautionary measures taken while rotating the shear wheel. However, as in most human error accidents which involve signaling procedures, someone eventually gave a wrong signal or someone made an assumption of seeing or hearing the wrong signal and the unexpected occurred. In this case, the power was inadvertently turned on while the operator was not in the clear of the shear wheel.

Corrective measures:

1. Prior to changing bits the machine shall be deenergized according to the provisions of Section 75.1725(c).

2. All persons must be in the clear and in a safe zone prior to the starting of any machinery.

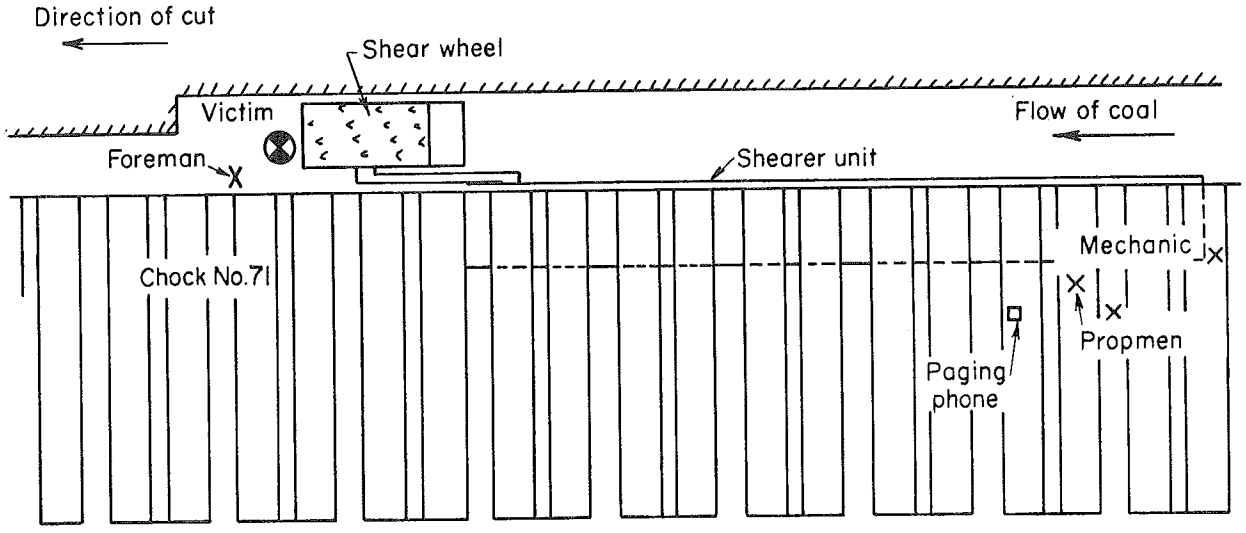


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
5/14/73	Section foreman, Age 43	11 1/2 years	3 years	Continuous miner/mine roof, ripper head

TYPE OF ACCIDENT: Crushed between the ripper head of the continuous miner and the mine roof.

CAUSE OF ACCIDENT: Changing bits on energized continuous miner. Utility man was lubricating CM utilizing integral hydraulic pumping system when the hydraulic pressure to the elevating jacks of the ripper head became activated.

FIGURE 25. - Changing bits on energized equipment.

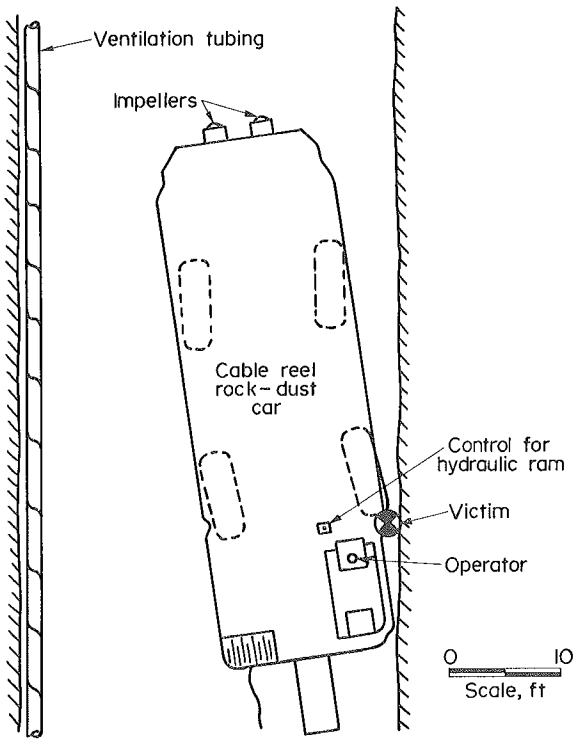


DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED / AGENCY
2/27/73	Shearing machine operator, Age 29	3 years	6 months	Single-ended shearer/ shear wheel

TYPE OF ACCIDENT: Crushed by shearer wheel

CAUSE OF ACCIDENT: Changing bits with the shearer energized. The shearing machine was inadvertently energized by another crew member.

FIGURE 26. - Changing bits on energized equipment.



DATE	OCCUPATION	EXPERIENCE TOTAL	EXPERIENCE PRESENT JOB	EQUIPMENT INVOLVED/AGENCY
5/3/73	Section foreman, Age 45	26 years	6 years	Rock-dust car/rib

TYPE OF ACCIDENT: Caught between rock-dust car and rib.

CAUSE OF ACCIDENT: Tramming rock-dust car before the section foreman could get in the clear.

FIGURE 27. - Unsafe position near moving equipment.

CATEGORY 10.--UNSAFE POSITION NEAR MOVING EQUIPMENT

In figure 27 we see how a section foreman (age 45, with a total of 26 years' mining experience) was caught between a self-propelled rock-dust car and rib. The victim was in the process of giving a roof bolter specific instructions in rock dusting when the accident occurred. Specifically, the roof bolter had just completed roof bolting the face of No. 4 entry when he was instructed to switch out the roof-bolting machine and to get the rock-dust car to rock dust the No. 4 entry. The roof bolter parked the roof-bolting machine and returned to the face of No. 4 entry with the rock-dust car. The foreman (victim) from his position between the rock-dust car and rib instructed the roof bolter to start the car and rock-dust distributor and tram out of the entry. In doing so, the victim was caught between the car and rib.

Corrective measures:

1. Operators of self-propelled mobile equipment shall not tram such equipment until all persons in close proximity are in a safe location. An alarm shall be sounded before tramming.

2. It is recommended that panic bars be installed on all self-propelled mobile equipment.